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Protecting MARKET SWEET CORN from the EUROPEAN CORN BORER

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No. 225

U. S. DEPARTMENT OF AGRICULTURE

PROTECTING MARKET SWEET CORN FROM THE EUROPEAN CORN BORER

By W. A. Baker, *senior entomologist,* D. D. Questel, *assistant entomologist,* and C. H. Batchelder, *associate entomologist, Division of Cereal and Forage Insect Investigations, Bureau of Entomology and Plant Quarantine*

The European corn borer (*Pyrausta nubilalis* (Hbn.)) causes serious losses in sweet corn, both that grown for the market and that grown for processing. Experiments have shown that sweet corn can be profitably protected and marketed green when certain insecticides are applied at the right time. The most useful methods are described in this leaflet. These methods, however, have not been perfected to the point where they can be profitably used on corn grown for processing.

Where the Borers Come From

In a considerable part of the infested area there are two generations of the corn borer each year. It is the first of these that damages early market sweet corn. The source of this infestation and the seasonal development of the insect are shown in figure 1. The borers pass the winter in the tunnels which they have made in cornstalks or other plant stems. In May and June they transform to night-flying moths which lay small white masses of overlapping eggs on the underside of the leaves of the young corn plants. A week later the eggs hatch, and the tiny larvae disperse to locations on the plants where they can find shelter and food.

Places Where Borers Feed in Corn

Young larvae that hatch early in the season crawl between the closely rolled leaves of the whorl and begin to feed. As the plant grows they descend farther into these protected locations. Later, as they become larger, they crawl into the growing tassel and into the silks and beneath the husks of the developing ears. Larvae that hatch late in the season, or during the "tassel-bloom" stage of plant growth, seek shelter in the ear, between the ear and the stalk, and between leaf sheaths and the stalk. As the larvae grow older they become borers, tunneling into the stalk and ear, where they are inaccessible to insecticidal treatment.

Spray Treatments

The most consistent control of the European corn borer in market sweet corn has been obtained through applications of sprays.

Spray Materials

Owing to the current unsettled commercial conditions, any recommendation of a particular spray material must depend on its avail-

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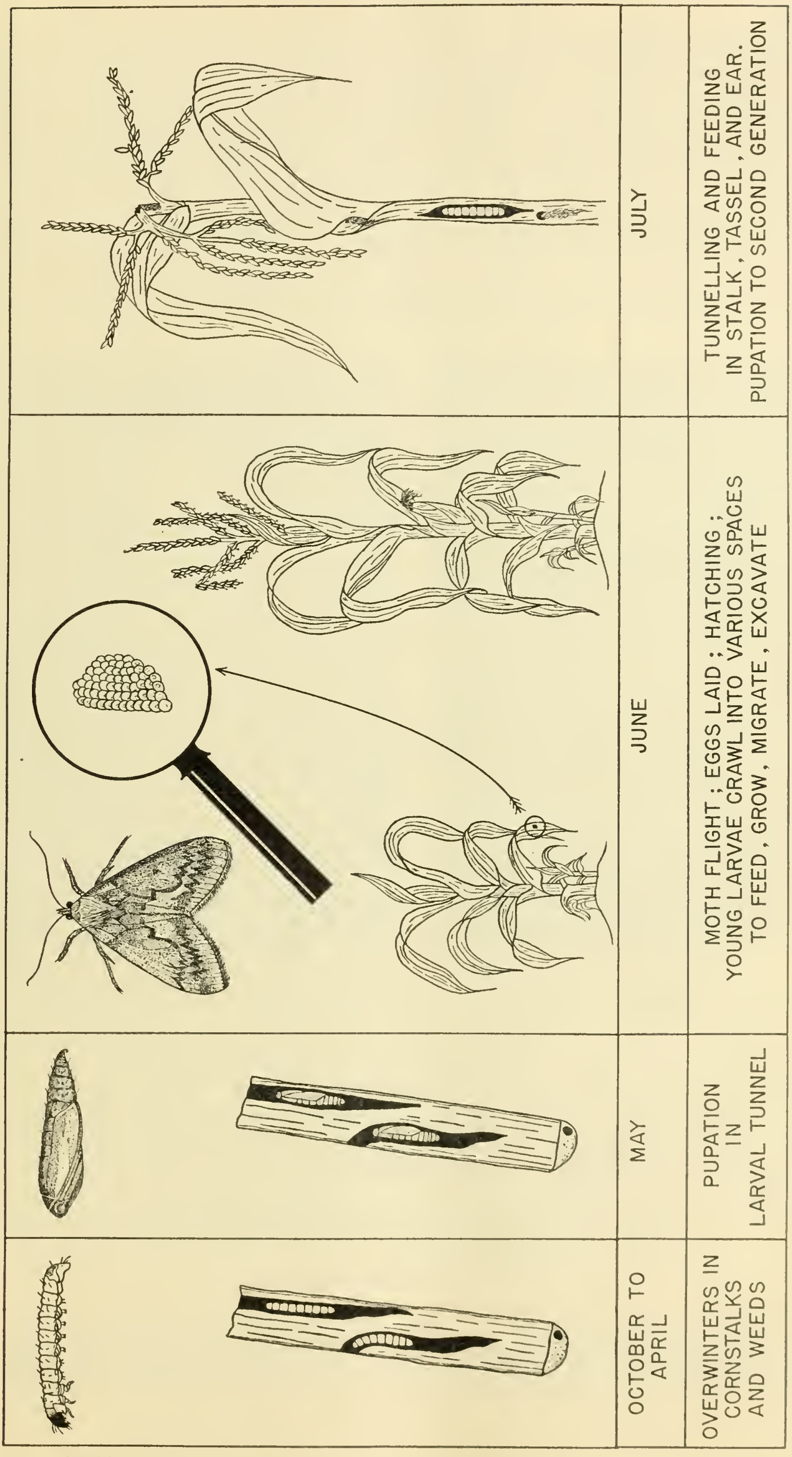
OCTOBER TO APRIL
OVERWINTERS IN CORNSTALKS AND WEEDS
MAY
PUPATION IN LARVAL TUNNEL
JUNE
MOTH FLIGHT ; EGGS LAID ; HATCHING ; YOUNG LARVAE CRAWL INTO VARIOUS SPACES TO FEED, GROW, MIGRATE, EXCAVATE
JULY
TUNNELLING AND FEEDING IN STALK, TASSEL, AND EAR. PUPATION TO SECOND GENERATION

Figure 1.—Stages in the seasonal development of the European corn borer where two generations occur.

ability. Although the most effective sprays found to date, considering cost and tolerance by the corn plants, are those made from finely ground derris or cube root, the war situation has made it necessary for the present to prohibit the use of these rotenone-containing materials on sweet corn. When derris or cube is available, 4 pounds of the ground root (containing not less than 4 percent of rotenone) are used per 100 gallons of water, plus a suitable spreading agent.[1] Until very recently rotenone-bearing powders containing the proper quantity of suitable spreading agent have been on the market. The current scarcity of rotenone materials, however, necessitates the recommendation and use of substitutes. Phenothiazine and tank-mixed nicotine bentonite have been found fairly satisfactory in the infested areas of the Eastern States, though less so in the Lake States. A spreading agent should be used with them.

The spreading agent facilitates the penetration of the spray deep into the whorl and between the leaf sheaths and the stalk where the larvae are feeding. Thorough wetting of these areas is necessary to insure reaching the young borers.

How To Mix Sprays

As there is danger of injuring corn by using too much spreader, the quantity of this should be carefully regulated. To prepare the spreading agent for mixing it with a spray, dissolve 1 pound of the spreader in 2 quarts of water and then add enough water to make 3 quarts (96 ounces) of solution. This makes a stock solution of the spreader sufficient for 300 gallons of spray.

When it is necessary to use phenothiazine to which a spreader has *not* been added by the manufacturer it should be added at the rate of 16 ounces of the stock spreader solution just described per 50 gallons of water (1 ounce per 3⅛ gallons). The procedure for mixing the spray is as follows: (1) Add the stock spreader solution to a small quantity of the water in a container, (2) add the phenothiazine to this solution at the rate of 2 pounds per 50 gallons of water (2 ounces per 3⅛ gallons), stirring the mixture until the phenothiazine is thoroughly wetted, and (3) add this mixture to the bulk of spray water, stirring it thoroughly.

If a nicotine bentonite spray is to be used, the completed spray mixture should contain materials in the following proportions: Water, 50 gallons; nicotine sulfate (40 percent nicotine), 8 ounces; dry Wyoming bentonite clay, 2 pounds; and the stock spreader solution already described, 16 ounces. The spray is prepared as follows: (1) Stir the stock spreader solution directly into the spray water, (2) slowly add the quantity of Wyoming bentonite clay, stirring it vigorously until it is thoroughly dispersed, and (3) add the proper amount of nicotine sulfate slowly, while stirring the liquid vigorously.

When use is made of a rotenone-containing powder, or of phenothiazine, to which the spreader has already been added by the manufacturer, it should be mixed into a thin paste with a small quantity of water before it is added to the full volume of water.

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[1] The only spreading agents tested that have given consistently satisfactory results without plant injury are sodium monosulfonate of butylphenylphenol, sold under the trade name Areskap, and aromatic monosodium sulfonate, sold under the trade name Ultrawet. Other spreading agents are on the market but the suitability of most of them for use in sprays for application to growing corn has not yet been determined.

When To Apply Sprays

It has been found that the first insecticidal application should be made when the first corn borer egg masses in the field begin to hatch. This establishes the beginning point of the treatment schedule. As egg laying and hatching continue during a considerable period, the first application should be followed by three additional applications at 5-day intervals. These additional applications are also necessary because during a 5-day period the insecticidal residues become diluted and new, unprotected surfaces become exposed through rapid growth of the plant.

The time when hatching of the borer eggs begins varies from year to year, and from field to field. For this reason the insecticide applications must be timed by the first hatching within the field to be treated. Careful and timely observations of the occurrence and hatching of the egg masses must therefore be made in each field. When hatched eggs are found, or eggs in which the black heads of the worms can be seen (fig. 2), it is time to make the first application. Equipment and materials should be made ready well in advance of the time when they are likely to be needed.

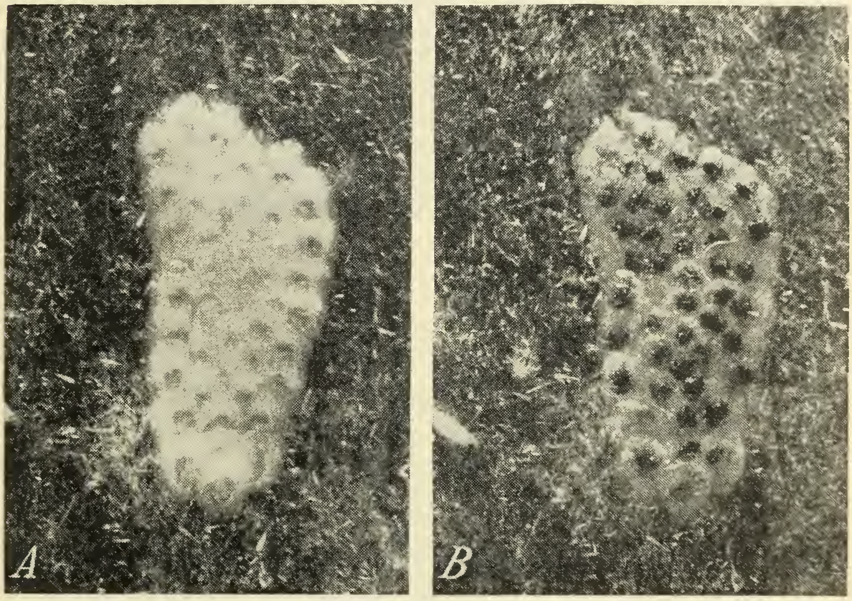

Figure 2.—Egg masses of the European corn borer: *A*, Newly laid egg mass; *B*, same egg mass in the black-head stage, just previous to hatching. Enlarged 7 times.

How to Apply the Spray

Enough spray should be applied so as to penetrate all the places where borers feed and to cause runoff at the base of the plant. The quantity of spray required for each application will range from about 75 to 150 gallons per acre, depending on the stand, size, and variety of corn.

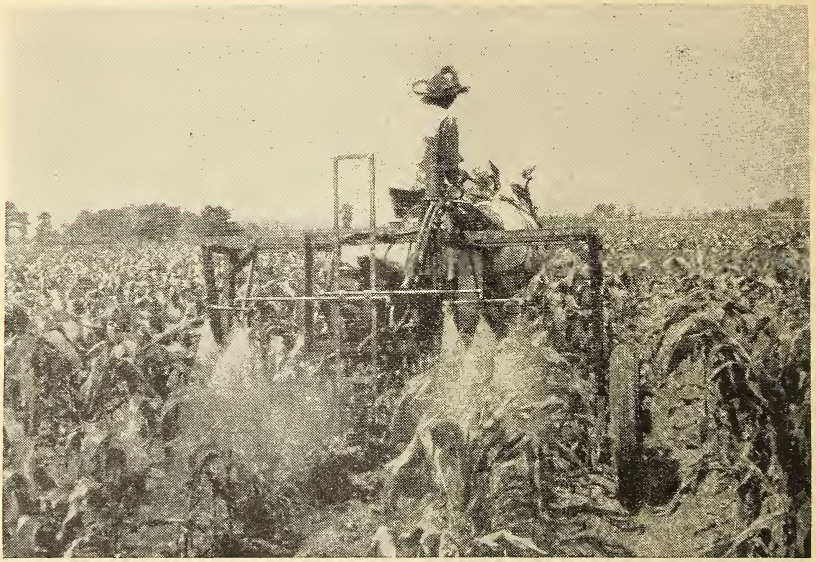

Figure 3.—Directing the spray into sweet-corn whorls with an experimental, horse-drawn, high-clearance, boom sprayer. (Photograph by Bureau of Agricultural Chemistry and Engineering.)

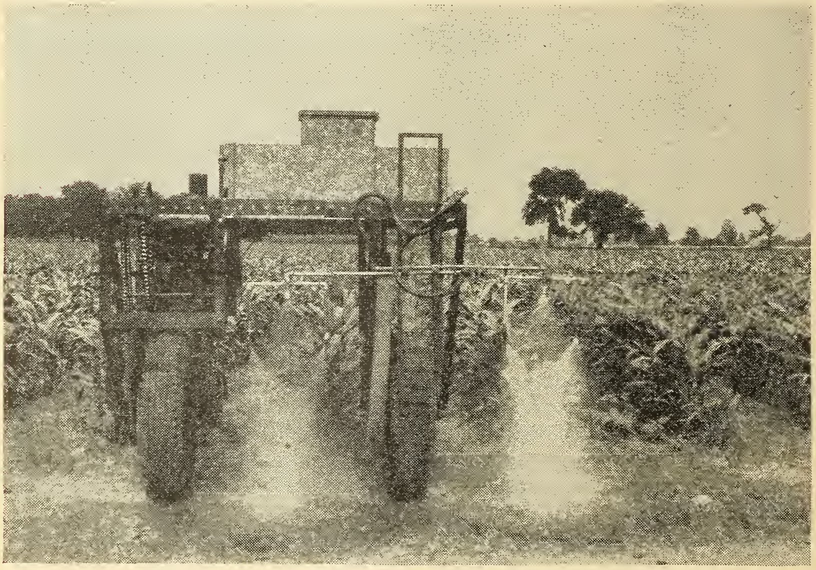

Figure 4.—Nozzle arrangements on an experimental, self-propelled, high-clearance, boom sprayer to give band of spray necessary for treatment of sweet corn. (Photograph by Bureau of Agricultural Chemistry and Engineering.)

CORRECTION SLIP

Leaflet No. 225, Protecting Market Sweet Corn From the European Corn Borer. Addition to first paragraph under heading, "Dust Treatment," page 7:

Owing to the shortage of rotenone resulting from war conditions, the War Production Board has found it necessary to limit the rotenone content of mixed insecticidal dusts to 0.5 percent. Experiments have shown, however, that good control of the European corn borer can be obtained with dusts containing only 0.5 percent of rotenone, if carefully and thoroughly mixed and applied at the rate of 45 to 50 pounds per acre per application. Except for this increased dosage in the case of 0.5 percent rotenone dust, the application of dusts should be made in accordance with the recommendations given in the last two paragraphs under this heading.

A nozzle delivering a solid cone rather than a hollow cone or other type of spray has been found the most satisfactory because it directs the insecticide more effectively toward the places where young borers are feeding.

In the early growth stages the spray should be directed downward into the whorl of leaves (fig. 3). When a power sprayer equipped with a boom is used,[2] three nozzles per row of corn should be provided. After the ears begin to develop, the two outside nozzles should be lowered to not more than 1 foot below the center nozzle and turned slightly inward. The direction of the spray should remain downward and toward the ear, forming a band of spray that will assure thorough treatment of all places where the borers are feeding (fig. 4). The insecticide should be constantly agitated in the sprayer during the application.

Compressed-air sprayers of the portable 3-gallon size (see cover page illustration) or the larger wheelbarrow type have been found useful for spraying in home gardens and small acreages. Horse-drawn (fig. 3) and self-propelled (fig. 4), high-clearance, boom sprayers have given highly satisfactory control of the borer when tested in commercial fields of sweet corn.

Dust Treatments

Although sprays have been found more effective than dusts for the control of the European corn borer, the dusts can be used at a profit in the Eastern States on sweet corn of high market value. Unfortunately, on account of war conditions and restrictions, rotenone dusts made of finely ground derris or cube root cannot be recommended for use on sweet corn at present, although they are among the most effective and satisfactory dust preparations. When they are available, either the ready-prepared or home-mixed dust should contain not less than 1 percent of rotenone.

The best alternative is a dual-fixed nicotine dust composed of dried nicotine tannate and dried nicotine bentonite containing 4 percent of nicotine. This dust can be obtained ready mixed on some markets and, although more expensive than rotenone-bearing powders, it can be used profitably on market sweet corn of high value.

The dusts should be applied four times at 5-day intervals, beginning with the hatching of the first eggs, and enough dust should be directed toward the parts of the plants inhabited by the borers to leave a noticeable deposit. Care should be taken to treat the developing ears thoroughly. The amount required will vary with the size and variety of plants to be treated and will be approximately 35 to 40 pounds of mixed dust per acre per application.

On small acreages the applications may be made with hand-operated bellows or rotary-type dusters fitted with a single nozzle. Power dusters are more practical for larger acreages. They should be designed for high row clearance and fitted with two nozzles per row arranged to direct the dust toward infested parts of the plants, whatever the growth stage of the corn to be treated.

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[2] Investigations of suitable equipment have been conducted in cooperation with the Bureau of Agricultural Chemistry and Engineering.

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